CHROMOSOME CONNECTIONS KIT©

DNA ~ Cell Division ~ Inheritance

Overall Student Learning Objective: What is a Chromosome?

Purpose: Many students experience difficulty in transferring what they know and learn about chromosomes that are visible with a light microscope to a molecular perspective of chromosomes with A-T and G-C nucleotide base pairing. The Chromosome Connections Kit© provides a modeling opportunity for students to make the connection between chromosomes at the microscopic scale with chromosomes at the molecular scale. We envision the kit being useful in studies of the cell cycle, the process of cell division (mitosis and meiosis) and inheritance.

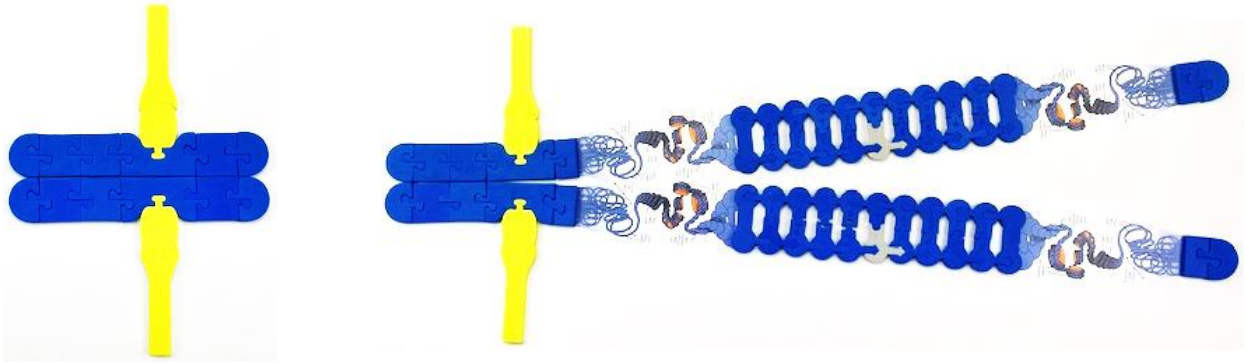
What Can Students Do with the Kit?

Students may model a variety of chromosome related structures and processes including but not limited to:

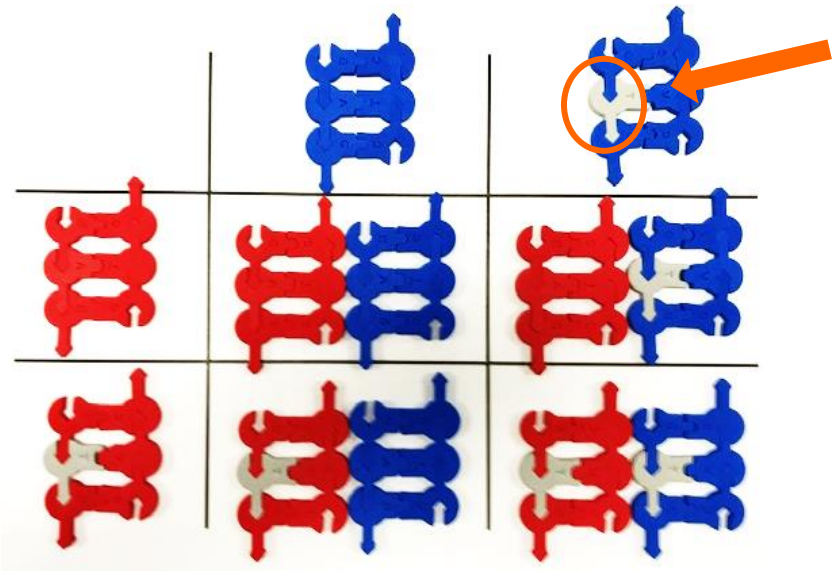
1. Model Chromosome Structure/Anatomy

sister chromatids, telomere, centromere, p and q arms, kinetochore, spindle fibers

Microscopic Scale **Molecular Scale**



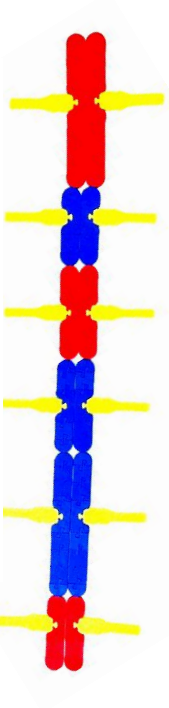
2. Construct Punnett Squares to Connect Inheritance of Traits to Chromosomes at the Molecular Level



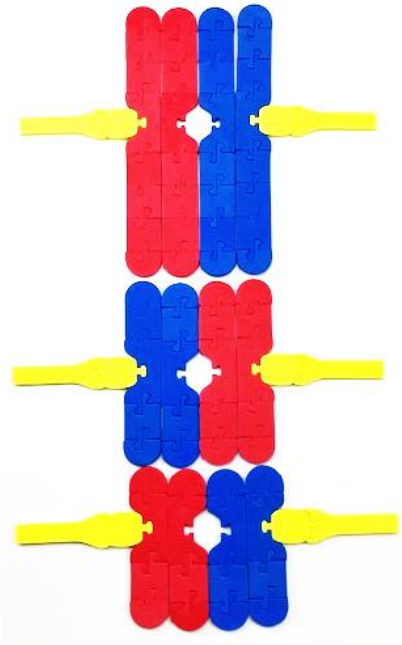
Indicates the single nucleotide base change from A to T resulting in sickle cell anemia.

3. Compare and Contrast Mitosis and Meiosis

Mitosis - Metaphase



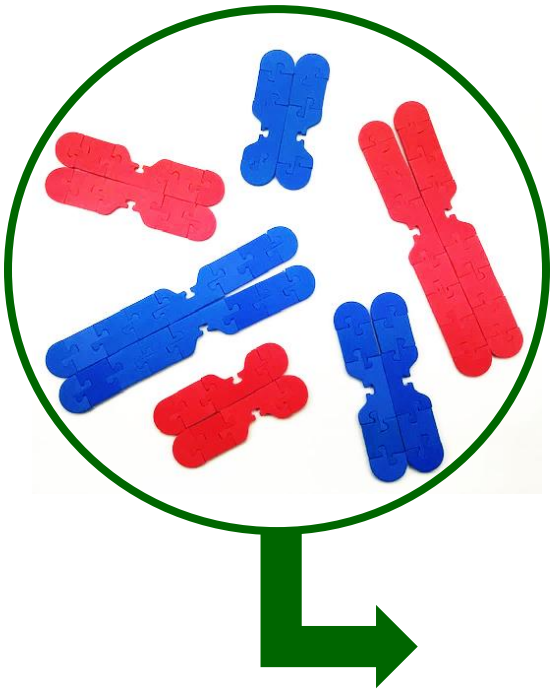
Meiosis – Metaphase 1



4. Model to Explain Mechanisms Contributing to Genetic Variation

A. Law of Segregation and the Law of Independent Assortment

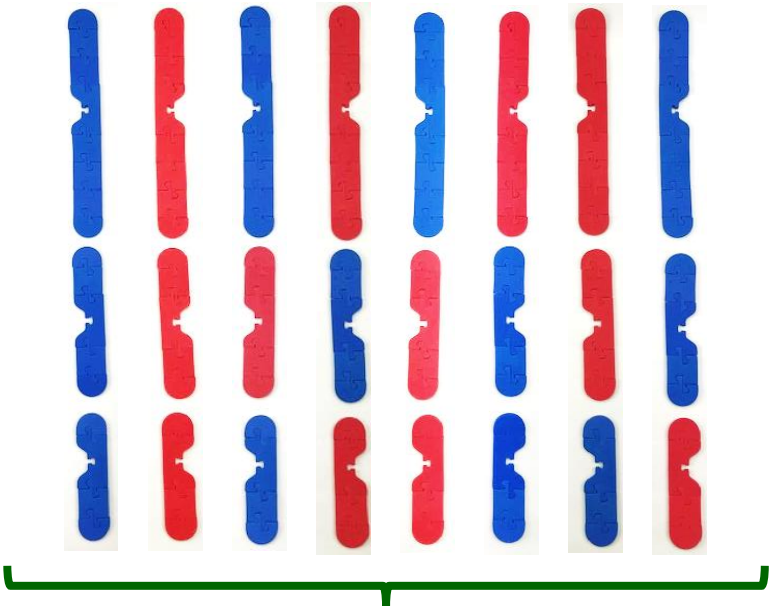
Parent Cell Chromosomes



2n (diploid number of chromosomes) = 6

n (haploid number of chromosomes) = 3

2^n (number of possible chromosome combinations after meiosis) = 8

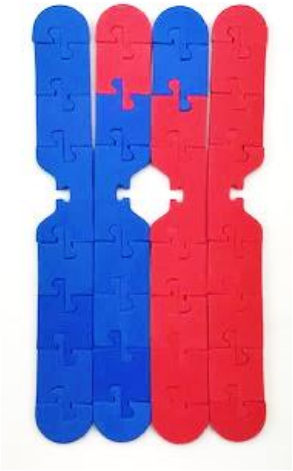


Possible Gametes

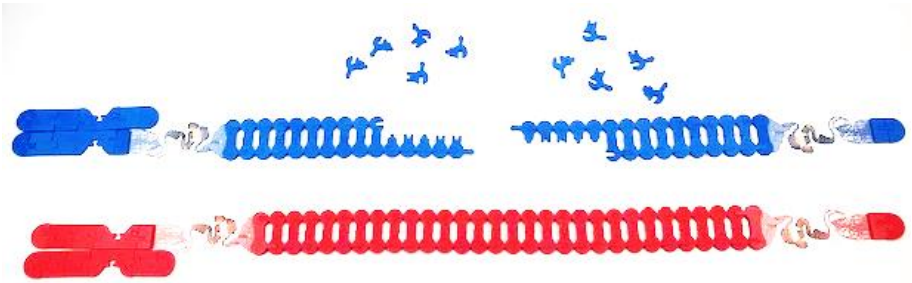
4. Model to Explain Mechanisms Contributing to Genetic Variation Continued . . .

B. Crossing Over

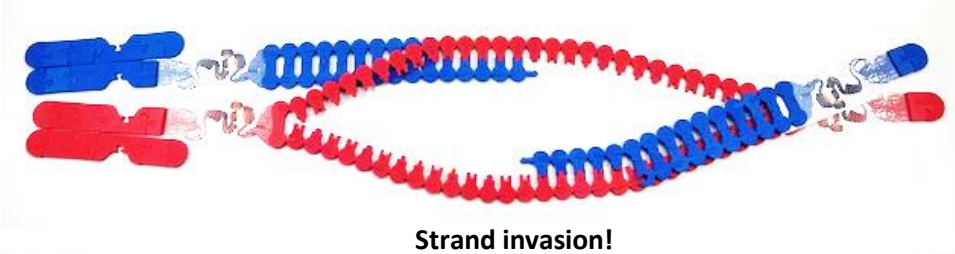
Microscopic Scale



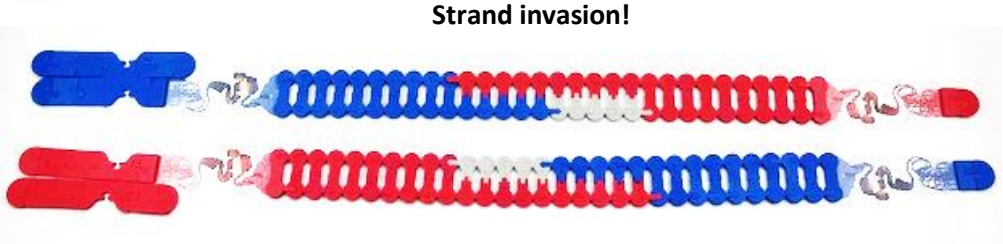
Molecular Scale



A double stranded cut with nuclease digestion.



Strand invasion!



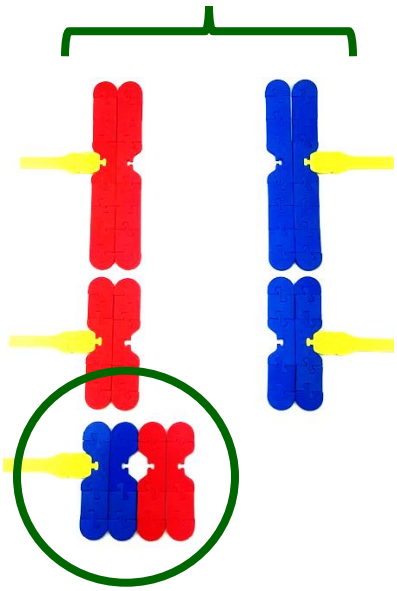
Resulting chromosomes in a single crossing over event.

5. Model to Explain Chromosomal "Aberrations"

A. Alterations in Chromosomal Number

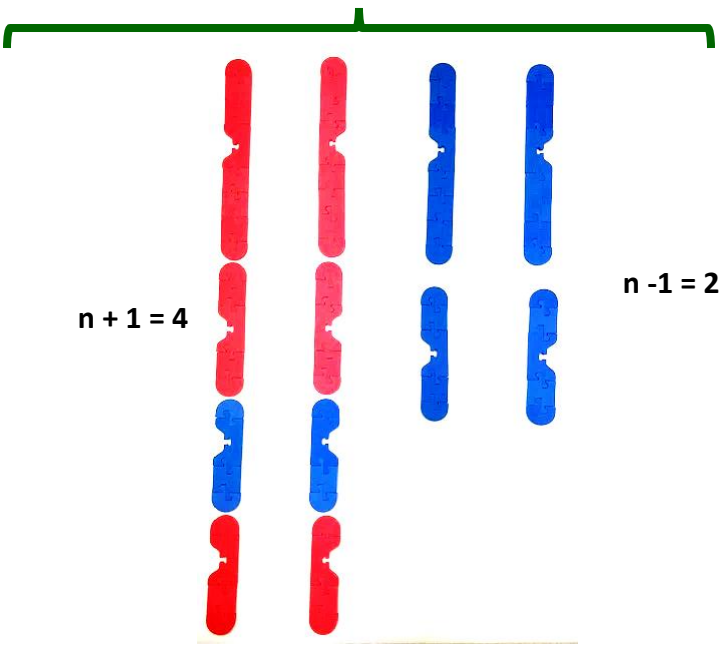
1. Nondisjunction in Meiosis I

Parent Cell Chromosomes



2n = 6

Possible Daughter Cell Chromosomes

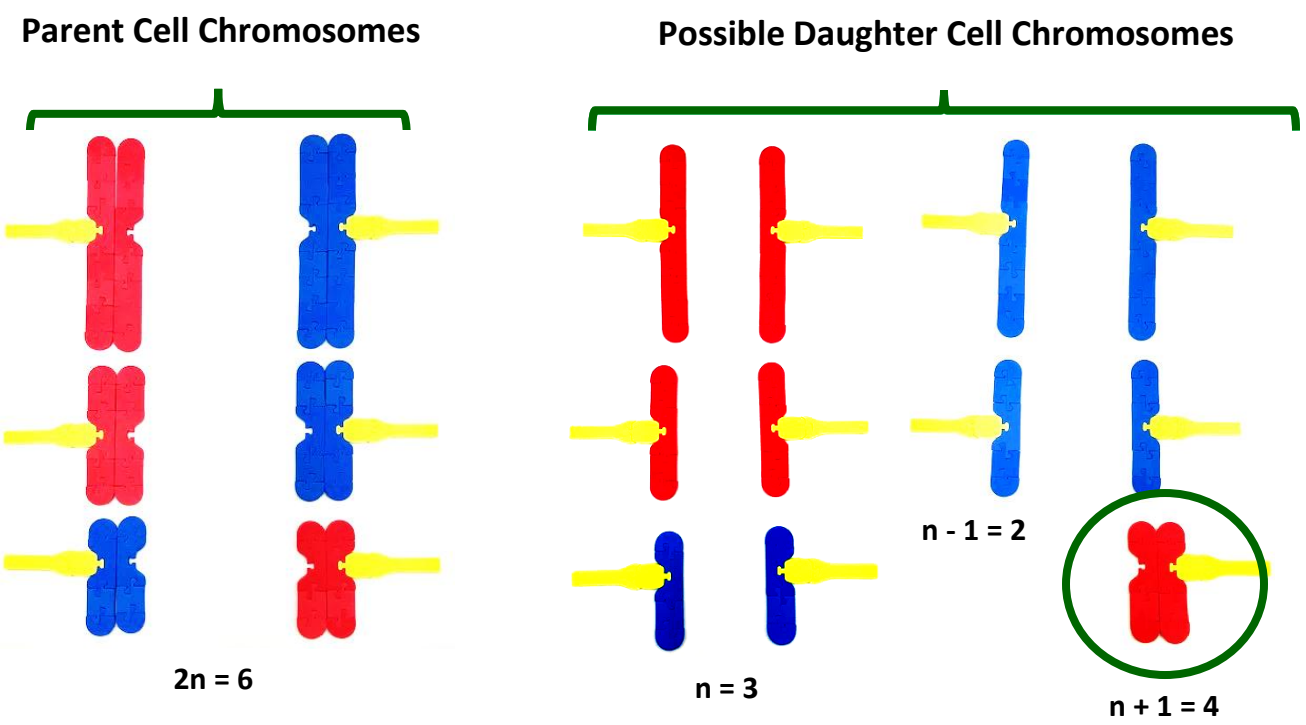


n + 1 = 4

n -1 = 2

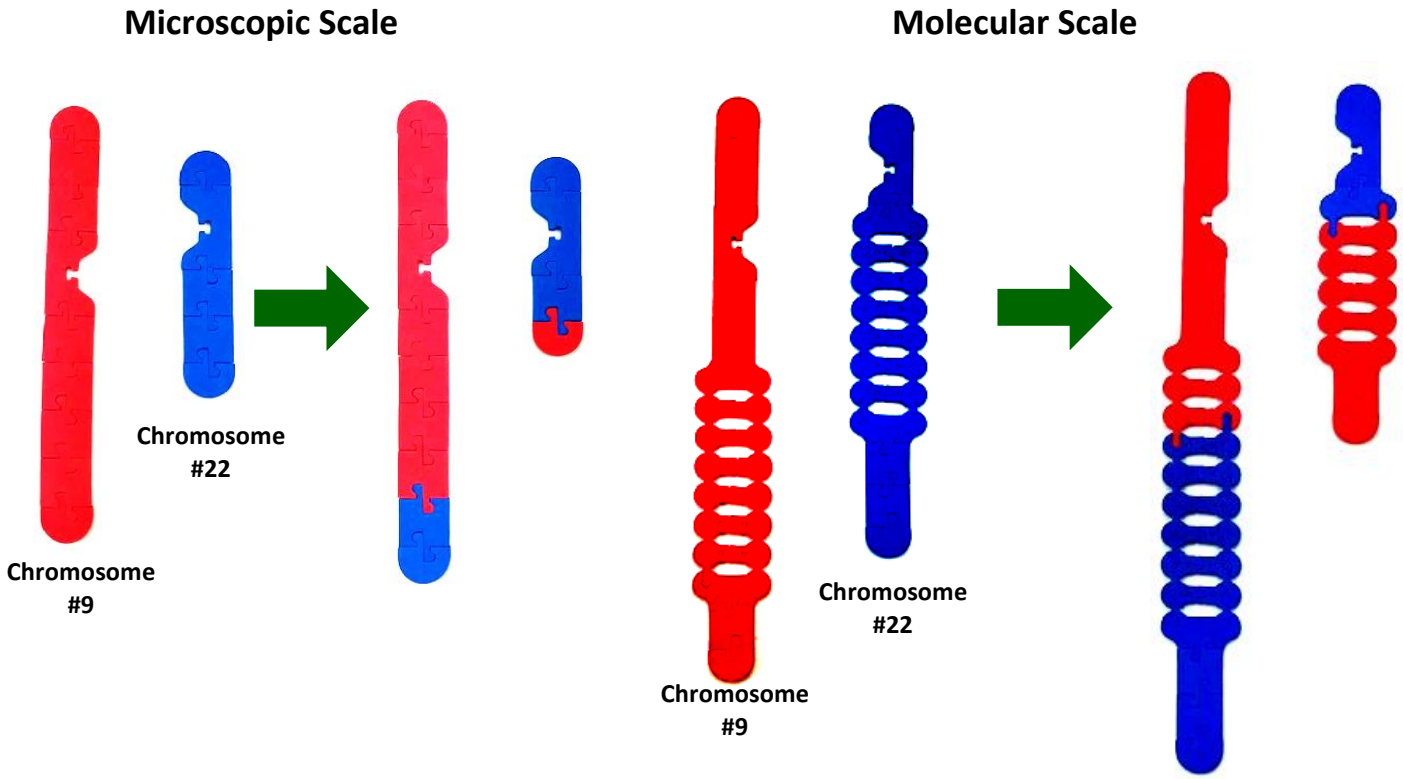
A. Alterations in Chromosomal Number Continued . . .

2. Nondisjunction in Meiosis II



B. Alterations in Chromosomal Structure

1. Translocation - Philadelphia Chromosome



2. Imagine modeling inversions, deletions, and duplications too!